Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

SHOUT
SHARE
IT

UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT BULLETIN No. 1143

Washington, D. C. ▼ April 10, 1923

DRY-LAND PASTURE CROPS FOR HOGS AT HUNTLEY, MONT.

By A. E. SEAMANS, *Assistant Agronomist, Office of Dry-Land Agriculture Investigations, Bureau of Plant Industry.*[1]

CONTENTS.

	Page.		Page.
Introduction	1	Results in 1919	12
Purpose and outline of the experiments	2	Results in 1920	14
Results in 1915	3	Results in 1921	16
Results in 1916	5	Study of the results with different crops	17
Results in 1917	7	Conclusions	23
Results in 1918	10		

INTRODUCTION.

The transition from cattle-range conditions to grain farming has been comparatively rapid in the Plains area of Montana.

Relatively high yields of wheat from low-priced land during the first few years when this change was taking place were a mighty stimulant toward the rather general adoption of this one-crop system of agriculture.

The experience of the older agricultural States has shown that a combination of live stock and crop farming formed the basis of a more permanent agriculture than where either grain or live stock was produced singly. Diversified farming as opposed to single-crop farming has frequently been demonstrated as a superior system of agriculture for the semiarid as well as for the humid sections of the country. There is ample reason to suppose that, in general, the dry-farming districts of Montana will prove to be no exception to this experience; and, furthermore, there have been numerous instances where the grain and forage returns from dry farms have been profitably marketed through live stock.

Live-stock production to a greater or less degree in connection with grain farming not only affords the dry-land farmer another direct source of income, but enables him to utilize profitably grain

[1] The results reported in this bulletin are from experiments conducted under a cooperative arrangement between the Montana Agricultural Experiment Station, the Office of Western Irrigation Agriculture and the Office of Dry-Land Agriculture Investigations, Bureau of Plant Industry, and the Bureau of Animal Industry, United States Department of Agriculture.

The following men from the Animal Husbandry Division of the Bureau of Animal Industry have been in charge of the animal-husbandry work at this station and have had the actual care of the hogs during the years specified: C. V. Singleton, 1917–1918; R. E. Gongwer, 1919–1920; and R. E. Hutton, 1921. George W. Morgan, who was in charge of the dry-land work at the Huntley, Mont., Experiment Farm from 1913 to 1915, outlined and conducted the experiments here reported during the season of 1915.

26063—23——1

and forage crops which of themselves are of secondary importance but which fit in well with approved crop rotations and agricultural systems. For example: Experiments have shown, and practical farmers have found, that in many parts of the dry-land sections of the State the yields of small grains grown after corn are almost as large as on summer fallow, and the net returns are correspondingly greater when the corn crop can be profitably used. Corn generally has a greater value when fed to live stock than when harvested and sold as grain. The return of fertility to the land through the medium of manure is recognized as a factor in establishing a system of permanent agriculture.

Where animals are produced, raised, and prepared for market on the farm it is generally essential that some sort of pasture be a part of the scheme. The open range or other native-grass pasture answers this purpose in many cases for cattle and sheep. In the more thickly settled communities pasture will often have to be confined to cultivated crops. Where this is the case, hogs will more often be used than any of the other meat-producing animals.

With this phase of dry-land farming in mind, a series of hog-pasturing experiments was outlined and begun at the Huntley, Mont., Experiment Farm in 1915.

PURPOSE AND OUTLINE OF THE EXPERIMENTS.

The principal purpose of the experiments was not so much to determine the value of the several crops pastured from the standpoint of profit in pork production as to collect agronomic data bearing on the following points:

(1) The seasons at which the different crops become available for grazing by hogs and the length of time each crop will furnish palatable forage.
(2) The carrying capacity or number of hogs per acre these crops will support.
(3) The possibility of fitting together or matching up these crops, by means of a rotation or otherwise, so that their respective pasture periods will form continuous grazing over a considerable season.
(4) The agronomic effect of manure, the result of pasturing, on the yield of crops.
(5) The economic merits of pasturing these crops as contrasted with the usual methods of harvesting them.

While these five points are of primary importance in this work, the behavior of the animals themselves in point of gain or loss in weight is important as an indicator of the palatability and the quantity of forage produced. For this reason the results of pasturing are presented in pounds of gain.

The plats used in the pasturing experiments were 1 acre in area. They were 620 feet long and 70.3 feet wide. A 7-foot alley separated the plats on their long sides, and a 20-foot road bounded them on the ends. Suitable fencing, shelter, and water facilities were provided for the animals on each plat.

Pigs of the Duroc-Jersey breed were used in this work whenever obtainable, and the animals were placed on the pasture as soon as the forage was ready.

Individual hog weights were taken frequently enough during the pasture season to compare the conditions of the animals with the depletion of the forage and to form a basis from which to calculate the grain supplements to be fed. These weighings usually took place at intervals of 10 to 14 days or oftener as conditions demanded. The initial and final weights used were generally the average of weighings made on three consecutive days.

The annual crops used were arranged in the form of a rotation and grown as follows: Winter rye seeded in disked pea stubble, followed by corn on spring plowing, followed by beardless barley (Success variety) on disked corn ground, followed by peas on fall-plowed barley stubble. To obtain estimates of yield and for the ultimate determination of the effect of pasturing on yield this rotation was duplicated. The crops in the duplicate rotation were grown by the same cultural methods but allowed to mature and were harvested by machinery in the ordinary manner.

In this rotation pasturing began with the winter rye. Usually 10 fall pigs were used on this pasture. They were placed on the rye in the spring at as early a date as the conditions of season and pasture would permit. This was usually early in May when the rye was from 5 to 8 inches high. The crop was pastured until it was either exhausted, had become unpalatable, or had to be abandoned in order that the pigs could be turned into the acre of peas at a time when they might receive the greatest benefit from this crop. While on the rye plat the hogs were fed once daily a ration of corn equal to 2 per cent of the live weight of the animals.

The plat of peas was grazed off in the same manner as the rye. Theoretically, peas are a grain crop, and pigs should require no corn supplement, but under conditions as actually experienced in the field it seemed advisable for one reason or another to continue the 2 per cent corn ration.

From the plat of peas the hogs were moved to the plat of Success barley. This crop was usually headed out and the grain either matured or approaching maturity. The barley is supposed to constitute a straight grain ration, on which hogs should approach a finished condition.

A small lot of spring pigs was used to harvest the standing corn on the fourth plat in the rotation.

The perennial crops pastured were alfalfa and brome-grass. Two 1-acre plats of each crop were grazed off in these experiments. On one plat of each crop the forage was grown in rows 2 feet apart, while in the second plat the forage was sown broadcast. With the exception of brome-grass in rows each of the perennial pasture plats was duplicated by plats from which the crop was harvested as hay by machinery.

Plats of sweet clover for pasture and harvest were seeded in 1916 and 1919, but on account of dry seasons there was no stand, and consequently this crop has not been used as pasture.

The perennial pastures were seeded in 1916, and pasturing began in 1917. The first year both fall and spring pigs were used to harvest these crops, but since then the grazing has been done by fall pigs only. These were placed on the fields as early in the spring as practicable and maintained there as long as the conditions of the forage and animals would permit. While on pasture the hogs were fed a 2 per cent supplementary ration of corn and were weighed about every two weeks. At the end of the pasture period they were removed to the feed lot for fattening.

RESULTS IN 1915.

Seasonal conditions affect dry-land crop production so profoundly as to materially affect both the conduct of the experiment and its

results. It therefore seems best to present the details of the experiment year by year. This allows opportunity for brief discussions of the seasons and explanation of apparent deviations or omissions from the outlined program.

The pasturing work in 1915 was of a preliminary character and was confined to the rotation of annual crops. The land used was broken from native sod the previous fall and all the crops were planted in the spring. This being the case, White Smyrna barley, a bearded variety, was used in place of winter rye. The season was cool, the rainfall was abnormally heavy, and all crops made yields considerably above the average. The hogs used were fall pigs of the Duroc-Jersey and Poland China breeds and were borrowed from neighboring farmers for the work.

Nine hogs, totaling 1,366 pounds, were placed on July 14 on the plat of White Smyrna barley, where they remained until July 30, a period of 16 days. At the time the pasturing began the barley was in the soft-dough stage. From the actions of the animals and the small gains made it was readily seen that the crop was unpalatable because of its beards, and the hogs were removed to the plat of Success barley. While on the White Smyrna barley a total gain of only 40 pounds for the lot was made. The check plat of this crop yielded 43.8 bushels of thrashed grain per acre.

Seven fall pigs having a combined weight of 986 pounds were put on the plat of peas on July 17, when the grain was in the dough stage, and remained on it until August 3. During this period of 17 days the lot made a total gain of 280 pounds, or about 2.4 pounds per pig per day. The check plat yielded 8.4 bushels of thrashed peas per acre, but as much of the grain was lost by shelling out during harvest the actual yield was somewhat higher. No supplementary ration was fed with the peas.

The plat of Success barley was stocked on July 17 with eight pigs weighing 1,224 pounds. On July 30 the nine pigs from the White Smyrna barley plat were added. At this time these pigs weighed 1,406 pounds.

The total lot of 17 pigs was removed from the Success barley plat on August 11. Thus, the crop carried eight pigs for a period of 25 days and nine pigs for a period of 12 days. The first lot of eight pigs made a total gain of 129 pounds, or an average daily increase of 0.65 of a pound each. The lot of nine pigs added on July 30 made a total gain of 90 pounds, or 0.83 of a pound per pig per day. The harvested plat yielded 33.2 bushels of grain per acre.

The plat of corn was harvested by 10 spring pigs weighing 1,115 pounds. This lot was placed on the corn on September 29 and remained there until October 24. A total gain of 480 pounds was made in the 25-day period. This is 1.92 pounds a day for each pig. One of the animals suffered from rheumatism toward the last of the season and did not gain as rapidly as the others. The plat of corn husked out by hand yielded 33 bushels of grain per acre.

The experience of 1915 was valuable in working out the relationship these crops have to one another in regard to cultural methods, growth, season of pasture, and palatability. Methods of handling the hogs and the technic in regard to taking the individual weights were also developed.

RESULTS IN 1916.

RYE.

The first season when the pasturing work was conducted according to the outlined program was in 1916. Some difficulty in procuring suitable hogs was experienced. Ten Duroc-Jersey pigs having a total weight of 1,171 pounds [2] were purchased locally by the Montana Agricultural Experiment Station and placed on the plat of rye on May 6. At this date the rye was jointing and was generally somewhat farther advanced than was considered most desirable for pasturage. The crop grew too fast to be held in check by the pigs, and by May 21 they were confining their grazing to small areas where the rye had been closely pastured and new growth was continually appearing. The unpastured rye was clipped with a mower to induce new growth over the whole plat. Timely showers started this growth, which was pastured until June 30, when the hogs were transferred to the plat of peas.

A total gain of 339 pounds was made by the hogs during the 55 days on rye pasture. While on the rye pasture a ration of corn weighing 2 pounds for each 100 pounds of hogs was fed. The total was 1,480 pounds of corn, or 4.37 pounds of corn for every pound of gain in weight of the animals. The average daily gain per pig was 0.62 of a pound.

The check plat of rye thrashed out 19.2 bushels of grain per acre.

The results of the rye pasturing for the season indicated that the forage is much more palatable while young. When the crop begins to head the pigs will not eat it but will confine their grazing to areas that have been kept pastured closely and where a new growth of rye is continually appearing. If sufficient moisture is available, a new growth of forage may be induced by mowing the rye when it gets beyond the palatable stage. There seems to be little doubt that the pigs were held on the rye pasture too long for the best results. A 2 per cent ration of corn proved to be about right as a grain supplement for the rye pasturage.

PEAS.

From the rye pasture the pigs were moved directly to the acre of field peas. The crop at this time was well advanced toward maturity, the grain being in the hard-dough stage. As the crop appeared to be insufficient to carry the hogs until the barley was ripe, the 2 per cent ration of corn was continued. The peas with corn supplement carried the 10 pigs for a period of 20 days, the lot being removed on July 20. During this time a total gain of 270 pounds was made, and 636 pounds of corn were fed as a supplement. This feeding ratio is 2.36 pounds of corn for each pound of gain, while each animal made an average daily increase of 1.35 pounds in weight. The plat was completely bare of vegetation when the animals were removed.

Peas on the check plat yielded 10.9 bushels per acre of grain of poor quality.

The experience of this year indicated that an acreage of peas double that of rye could be used satisfactorily. This would permit

[2] After the grazing was well under way it was found that one of the animals had been bred before she was purchased. The actual weights of this animal while on rye, peas, and barley pastures have not been used in the calculations, but a weight equal to that of the average of the other nine pigs has been substituted for the actual weights of this animal.

leaving the rye at an earlier stage of its growth and pasturing the peas when they were not so mature, and the increased acreage would more completely fill the gap between rye and barley. With more forage containing an increased total weight of grain, it is possible the corn ration could be dispensed with. Peas appear to be very palatable, both grain and vines being consumed.

BARLEY.

The 10 pigs were moved on July 20 from the plat of peas to the plat of Success barley where they remained until August 7, a period of 18 days. At the beginning of the period the barley was in the hard-dough stage, but many of the plants along the edge of the plat were still comparatively green. It was observed that these green plants were consumed by the pigs before grazing the mature barley. During the first 10 days of the period a total gain of 42 pounds was made, but during the last 8 days the animals lost in weight to such an extent that the returns for the entire period on barley showed a loss of 14 pounds for the lot. Though the barley was all eaten, it was clearly evident that much of it was not digested by the animals and therefore not assimilated.

The crop on the acre check plat yielded 9.7 bushels of thrashed grain per acre.

There seems to be ample evidence that the barley was too mature to be of the greatest benefit to the hogs. This crop approximated a full grain ration, and it is possible that some roughage, such as alfalfa hay, should be fed along with the barley pasturage when the crop is so far advanced. If hogged-off when in a greener stage, there would probably be no need for a supplement.

The total increase in weight of the 10 pigs for the rye, peas, and barley pastures was 595 pounds during the 92-day period, and the corn fed totaled 2,116 pounds. At the end of the period the hogs were not in a finished condition, but they had developed large frames and fattened readily in the feed pens.

CORN.

A lot of four spring-farrowed pigs weighing 435 pounds was placed on the acre of corn on September 30. At this time the corn was nearly ripe, and the pigs consumed it readily. When the animals were removed at the end of a 9-day period, the corn was well cleaned up, and the pigs had made a gain of 71 pounds, or 1.97 pounds per pig per day.

The acre check plat husked out 16.5 bushels of corn of poor quality.

The ratio of corn consumed (using the yield of the check plat as the basis for figuring the yield of the pastured plat) was 13 pounds of corn to a pound of gain. As the corn consisted of a very large percentage of small ears, or nubbins, distributed throughout the entire plat, considerable energy had to be expended to find them. There seems to be little doubt that more satisfactory gains would have been obtained if the animals had been removed from the corn at an earlier date rather than left on the plat until all the corn had been found.

A small quantity of alfalfa hay was given the hogs while on the corn pasture, but they apparently ate very little of it.

RESULTS IN 1917.

RYE.

In 1917 a scarcity of suitable hogs for this pasturing work allowed but six Duroc-Jersey fall pigs to be used on the rye plat.[3] These began the grazing period on May 11 at an initial weight of 499 pounds. At this date the rye was about 6 to 7 inches high and well tillered. The forage appeared to be very palatable and was eaten readily by the animals during the early part of the season. The small number of pigs to the acre was not sufficient to keep the pasturage grazed down. By June 19 a large part of it had become too coarse to be palatable and the animals were confining their feeding to small areas where the rye had been kept short and new growth was appearing. The coarse forage was clipped, and a new growth came on immediately. This was consumed, but the gains made from it did not equal those made earlier in the season. The animals were removed on July 17. A total weight of 762 pounds was recorded on this date, showing a gain of 263 pounds for the 67-day period, or an average of 0.65 of a pound per pig per day. The corn fed totaled 910 pounds for the period, or a ratio of 3.46 pounds of corn per pound of gain.

The poor growth of the rye toward the end of the period would have justified removing the hogs at least 10 days earlier.

Rye on the check plat yielded 10.4 bushels per acre.

PEAS.

The crop of peas was seriously affected by a cold wet spring, which so reduced germination that the stand was estimated at about 30 per cent. The forage was further reduced by a hailstorm on July 4, that stripped pods and leaves from the vines and beat them into the ground.

The pigs were held on the rye pasture longer than the forage warranted in order to give the peas a chance to recover. On July 17 the plat was stocked with six pigs from the plat of rye. At this date the few peas remaining on the vines were in the green-pea stage and therefore younger than was the case in 1916. The percentage of grain to vines was very small, and the 2 per cent ration of corn was again deemed advisable to supplement the pasturage.

The six pigs harvested the plat in 22 days and were immediately removed to the acre of beardless barley. A total gain of 174 pounds was made. This was at the rate of 1.32 pounds per pig each day and was made on a corn ratio of 1 pound of gain for each 2.06 pounds of corn fed.

The acre check plat returned 2.3 bushels of thrashed peas. An estimate made at the time of harvest was to the effect that about 50 per cent of the peas had been beaten from the vines and could not be gathered for thrashing.

In spite of the hailstorm and other factors the 1 acre of peas with the corn supplement furnished continuous grazing for six pigs for the 22 days between the rye and barley pastures.

---

[3] One of these animals was found to be with pig after the experiment started and was removed from the plat at the end of 61 days. A weight equal to the average of the other five hogs is used for this animal in all calculations made for rye. This hog was replaced by another on the pea and barley pastures. This substitution accounts for the discrepancy of 21 pounds in the weight of the lot at the end of the rye and the beginning of the pea pasture.

BARLEY.

The barley plats were somewhat affected by the hailstorm but recovered more completely than did the peas.

The lot of hogs from the peas weighed 915 pounds when placed on the barley plat on August 8. The grain was well filled at this time, but the crop was not nearly as mature as in 1916. That it was more palatable than during the previous year was evidenced by the way the animals consumed the entire plants, rather than limiting themselves to the grain. There were not enough pigs to harvest the whole acre while it was in this stage, so the forage was rather well matured by the end of the season. Though the hogs were kept on the plat until all the grain was consumed, it was apparent that they were getting little benefit from the matured barley and they were removed on August 22.

A total gain of 60 pounds was made during the 14-day pasture period. This was an average daily gain of 0.71 of a pound per pig.

The check plat yielded 16.2 bushels of mature grain per acre. Using this yield as an estimate of the grain consumed it appears that 12.95 pounds of barley were required for 1 pound increase in weight.

Rye, peas, and barley pastures returned a combined total of 497 pounds gain in weight for six pigs in a period of 103 days. A total of 1,268 pounds of corn was fed as a supplement to the rye and pea pasturage. As was the case in 1916, the animals were not in a finished condition at the end of this season but had made a good growth and fattened readily in the dry lot.

CORN.

Six spring pigs, totaling 442 pounds, were placed on the acre of corn on September 28. The corn was well ripened and was of a better quality than in 1916, though the yield was somewhat less. It required 17 days to hog-off the corn, and the animals were removed on October 15. During this period the total increase in the weight of the lot was 103 pounds, or 1.01 pounds per day for each pig.

The acre check plat yielded 9.6 bushels of corn of good quality. Using this yield as a basis of calculation the gains were made at the rate of 5.22 pounds of corn per pound of gain. The corn crop was not large enough to finish the animals to a marketable size and condition.

ALFALFA AND BROME-GRASS.

The alfalfa and brome-grass crops were seeded in 1916 in 1-acre plats. One plat of each was planted in rows 2 feet apart and one with rows 6 inches apart. In this bulletin the first is referred to as the row plat and the second as the broadcast plat. Good stands were obtained, and excellent pasturage was available in the spring of 1917. A sufficient number of fall pigs was not available for grazing off these plats efficiently, but five pigs having a total weight of 438 pounds were given access to the 2 acres of alfalfa on May 16. On the same date five similar pigs, totaling 427 pounds, were placed on the 2 acres of brome-grass. A 2 per cent ration of corn was fed each lot daily.

Both lots were carried on their respective pastures for a period of 56 days, being removed on July 11. The forage on each plat having made more growth during this period than the small number of pigs could consume, all plats except the brome-grass in rows were mowed. The 2 acres of alfalfa yielded 1,632 pounds of fair quality hay. The acre of broadcast brome-grass appeared to be more unpalatable

than the row plat and was harvested at the same time as the alfalfa plats. This brome-grass plat yielded 1,880 pounds of good quality hay. The row plat of brome-grass, though much of the forage grew tall and was not eaten, seemed to furnish a greater quantity of acceptable grazing around the crowns of the plants, and the hogs confined themselves to this plat almost exclusively after the first two weeks of the season.

The gain of the fall pigs on alfalfa amounted to 232 pounds, or 0.83 of a pound per pig per day. The brome-grass pigs gained 190 pounds for the same period, or 0.68 of a pound per pig per day. The alfalfa pigs made their increase at the rate of 2.78 pounds of corn per pound of gain, while the brome-grass pigs required 3.2 pounds of corn for each pound of gain.

The comparison seemed to favor the alfalfa pasture, though actually most of the brome-grass grazing was done on the 1 acre of brome-grass in rows.

The check plat of alfalfa seeded broadcast was cut on June 29 and yielded 1,850 pounds of hay per acre, while the broadcast plat of brome-grass returned 2,560 pounds of hay per acre. No check plats of these crops in rows were available.

After removing the fall pigs from the pastures on July 11 the plats were restocked with spring pigs. Ten pigs were placed on each of the crops. The total hog weight for the 2 acres of alfalfa was 356 pounds and for the 2 acres of brome-grass 357 pounds.

As but little growth was made on the broadcast alfalfa plat after it was mowed, the spring pigs confined themselves to the row plat entirely. The dry season enabled the animals to keep the new growth grazed off fairly close over the whole acre, but the tendency to continually pasture certain areas was the same as that experienced with the rye pasture. On August 8 one pig was removed from the experiment because of sickness, and from that time until the experiment closed on September 28 nine pigs were used. During the 79-day period a total of 249 pounds of gain was made. This averaged about 0.34 of a pound per day for each animal. The corn consumed was 767 pounds, or 3.09 pounds of corn for each pound of gain. For the greatest and most economical gains the pasture season should have closed about three weeks earlier.

As was the case with the alfalfa, the row plat of brome-grass was pastured by the spring pigs in preference to the broadcast plat.

The row plat of brome-grass was mowed on July 24 and yielded 944 pounds of coarse hay. The subsequent new growth was pastured close by the 10 pigs for a period of 25 days, when they were removed. A gain of 32 pounds was made, or an average daily gain of 0.13 of a pound per pig. Shelled corn weighing 231 pounds was fed during this time, or a ratio of 7.22 pounds of corn for each pound of gain. A greater income from the pasture would have been secured if the hogs had been removed a week earlier.

The season's observations on alfalfa and brome-grass as hog pastures indicated that both crops were very palatable. It seems reasonable to suppose that placing a larger number of pigs on these crops early in the season would bring more profitable returns than the summer pasturing and also leave the pastures themselves in better shape.

The row plats of each crop furnished a more continuous growth of palatable forage than the broadcast plats.

26063—23——2

RESULTS IN 1918.

RYE.

On May 7, 1918, 10 pure-bred Duroc-Jersey fall pigs, having a combined weight of 964 pounds, were turned on the rye pasture. The forage averaged about 6 inches in height on this date, and it was in good condition for grazing. June 5 found the animals confining their pasturing to the more closely grazed areas, while rye on the neglected areas grew tall and coarse. This was cut with a mower as it was beginning to head out. Though some new growth was induced from the clipped plants, the season was such that this growth was smaller than in former years, and the animals had little difficulty in keeping the whole acre pastured close. The hogs were removed from the plat on June 25. The total gain made during the 49-day period was 227 pounds, or an average daily increase of 0.46 of a pound per hog. The corn fed was 1,078 pounds, or 4.75 pounds of corn for each pound of gain in hog weight.

The check plat of rye made 10.1 bushels per acre.

PEAS.

The hogs from the rye plat were moved to the plat of peas on June 25. On this date a light hailstorm did some damage to the peas by stripping the young pods from the vines. The total weight of the animals when the pea pasturing was started was 1,191 pounds. As the forage was green and succulent, the corn ration was continued. At the end of a 14-day period the peas had been entirely cleaned up, and the hogs were placed on the acre of barley.

A gain of 229 pounds was made by the 10 pigs on peas. This is at the rate of 1.64 pounds per day for each pig. The total corn fed was 364 pounds, or a ratio of 1.59 pounds of corn for each pound of gain.

Peas which were harvested and thrashed yielded 5.6 bushels for the acre. It was estimated that about 50 per cent of the grain from this plat was lost because of the hailstorm.

A greater acreage of peas could have been used to advantage in 1918, as in former years.

BARLEY.

The barley crop had begun to dry up when it was stocked by the 10 pigs from the pea plat on July 9. The lot at this time weighed 1,420 pounds. At the end of the first 14-day period it was obvious that the pigs would not make satisfactory gains on the crop, and they were removed. In addition to the grain being of poor quality, the crop had become badly mixed with bearded varieties of barley which the pigs refused to eat.

The maturity of the barley made it seem advisable to supply a roughage ration with the pasturage, so alfalfa hay was fed in racks. A total of 52 pounds of hay was consumed during the 14 days. When the pigs were removed from the barley on July 23 they weighed 1,420 pounds, which was the same as their initial weight on this plat.

The check plat of barley made 3 bushels per acre of poor-quality grain.

The continuous pasture of rye, peas, and barley made a total gain of 456 pounds. A total of 1,442 pounds of corn was fed while the animals were on the rye and pea pastures.

CORN.

The quality of corn pastured was rather poor, and the yield was small. Six spring pigs weighing 442 pounds were placed on the plat of corn on September 6. Twelve days were required to complete the harvesting of the crop. The total gain made was only 54 pounds, or 0.75 of a pound per pig per day. During this experiment the hogs were supplied with alfalfa hay, but consumed only 8 pounds during the 12 days.

The check plat of corn yielded 8 bushels per acre. Using this yield as a basis for estimating the grain produced on the pastured plat, it required 8.3 pounds of corn to make a pound of gain.

ALFALFA.

A scarcity of fall pigs did not permit pasturing the entire acre plats of alfalfa to the best advantage, so the plats were divided and only half an acre was used in each case. For comparison the returns are reduced to an acre basis.

The broadcast plat was stocked at the rate of eight pigs to the acre and the row plat at the rate of six pigs per acre. This difference seemed advisable, as the longer grazing period given the row plat in 1917 resulted in the killing out or damaging of the forage to a greater degree than was experienced on the broadcast plat. This damage seemed to be confined entirely to the continuously grazed areas of the year before.

The alfalfa was about 7 inches high when the grazing began, and it seemed to be making a good growth.

The initial weight of the six hogs on the row plat was at the rate of 532 pounds per acre, and the eight hogs on the broadcast plat had an acre weight of 702 pounds. The animals remained on both plats until the forage became unpalatable, owing to the coarseness of the growth and the drought which hindered new growth. Both lots were removed on July 9, after a pasture period of 63 days. The lot on the row plat made an increase of 296 pounds per acre, or 0.78 of a pound per day per pig, while the lot on the broadcast plat gained an acre total of 348 pounds, or an average daily gain of 0.69 of a pound per pig. The ratio of corn fed to gain was 3.01 pounds of corn to 1 pound of gain on the row plat, and 3.3 pounds of corn to 1 pound of gain on the broadcast plat. The row plat made a greater daily gain per pig and did this on a lower corn ratio than the broadcast plat, but the latter made the greater gain per acre.

Contrary to expectations, however, the forage on the row plat seemed to suffer more from drought than did that on the broadcast plat. The ground between the rows of alfalfa was packed hard by tramping, and in many places the soil was deeply cracked. This condition was absent on the broadcast plat.

The unpastured halves of each plat were cut for hay and yielded 1,224 pounds per acre for the row plat and 1,800 pounds per acre for the broadcast plat. The acre check plat seeded broadcast made 1,254 pounds per acre.

BROME-GRASS.

Owing to the small number of hogs available for the work, the brome-grass pastures were reduced to half an acre each, as had been done with the alfalfa plats. Each half acre of brome-grass was supplied with four fall pigs on April 30. This was a week earlier than

the alfalfa pastures were stocked, but was warranted by the earlier and more rapid spring growth made by the brome-grass. On this date the grass was 8 inches high. Hogs on the row plat weighed 764 pounds per acre, while those on the broadcast plat had an acre weight of 778 pounds. The forage carried each lot until July 9, a period of 70 days. At this time the pasturage was so coarse and unpalatable that satisfactory gains were not being made. The grass on the row plat was tall and coarse, while that on the broadcast plat was short and dry.

Pigs on the row plat returned an acre gain of 350 pounds, or a daily gain of 0.63 of a pound per pig. The broadcast plat yielded 374 pounds of gain per acre, or a daily average of 0.67 of a pound per pig. The corn consumed on each plat was 1,344 pounds. This was a ratio of 3.84 pounds of corn per pound of gain for the row plat and 3.59 pounds of corn per pound of gain for the broadcast plat. The results were somewhat in favor of the broadcast brome-grass.

The unpastured halves of each plat were cut for hay on June 15. From the row plat 1,392 pounds of hay per acre were obtained, while the broadcast plat yielded 720 pounds of hay per acre. The check plat of brome-grass sown broadcast yielded 664 pounds of hay.

RESULTS IN 1919.

RYE.

Conditions in 1919 were favorable for starting the pasture work about two weeks earlier than heretofore. Ten fall pigs with a total weight of 1,103 pounds were placed on the acre of rye on April 25, when the crop was about 7 inches high. The animals took to the forage readily and during the early part of the period made good gains. The season was very dry, and the growth of rye was checked to such an extent that the 10 pigs were able to keep the whole plat eaten off uniformly. This was the first year the plat did not need to be clipped to prevent the unpastured plants from maturing.

At the end of 56 days the hogs were removed and placed on the plat of peas. The gains made amounted to 287 pounds, which was an average daily increase of 0.51 of a pound for each animal. The corn fed was 1,403 pounds, or a ratio of 4.89 pounds of grain per pound of gain.

The check plat made 3.6 bushels per acre.

PEAS.

The crop of peas was severely damaged by drought, and but little forage was produced. The 10 pigs were placed on the plat on June 20 when they weighed 1,390 pounds. The peas were in the green-pea stage and were readily eaten.

The small crop cut the pasture period to seven days, the pigs being removed on June 27. A gain of 77 pounds was made by the lot during this period. The average daily increase was 1.1 pounds per day per pig and was made with the aid of 207 pounds of corn supplementing the forage, a ratio of 1 pound of gain to 2.69 pounds of corn.

The check plat of peas dried up before harvest, and no yield was obtained.

A total gain of 364 pounds was made on the rye and pea plats during the combined periods amounting to 63 days. A total of 1,610 pounds of corn was consumed.

BARLEY AND CORN.

The barley and corn plats dried up before making grain, and neither of these crops was grazed. No yields were obtained on the check plats.

ALFALFA.

As the effects of overpasturing in 1917 were still in evidence, the acre of alfalfa in rows was stocked on May 9 with only four fall pigs. These pigs had a total weight of 318 pounds. On the same date seven fall pigs weighing 530 pounds were placed on the broadcast plat of alfalfa. The forage on both plats was about 6 inches high at this time. Both lots made good gains during the first half of the season, but drought and hot weather reduced the average, as the growth of alfalfa was checked.

The pigs were removed from both pastures on June 27. The gain made on the row plat amounted to 130 pounds, or 0.66 of a pound per pig for each day of the 49-day period. On the broadcast plat the pigs increased in weight 188 pounds. This was an average daily gain of 0.55 of a pound for each animal. The pigs on the row plat received 376 pounds of corn, or 2.89 pounds of corn for each pound of gain. The pigs on the broadcast plat made 1 pound of gain on 3.21 pounds of corn, a total of 604 pounds of corn being fed. While the row plat by reason of the poor stand supported a smaller number of pigs and made a smaller gain per acre than the broadcast plat, each pig in it made a greater daily gain on a lower ratio of corn.

Alfalfa on the check plat was too small to be harvested, and so no yield was obtained.

BROME-GRASS.

Six fall pigs were put on each acre of brome-grass on April 25. The grass at this time was 7 inches high and was readily eaten by the animals.

The pigs on the row plat had a combined weight of 582 pounds, while those on the broadcast plat totaled 579 pounds.

Drought during the latter part of the grazing season curtailed the growth of forage and reduced the gains made by the hogs. Both lots were removed on June 14, after having been on the pastures 50 days. During this period the lot on the row plat gained 144 pounds, while that on the broadcast plat gained 191 pounds. The former averaged 0.48 of a pound daily for each animal, while the latter averaged 0.64 of a pound per day. The hogs on the row plat consumed 653 pounds of corn, or 4.53 pounds of corn for each pound of gain. The lot on the broadcast plat received the same weight of corn and made gains at the ratio of 1 pound to each 3.42 pounds of corn fed.

Both plats were grazed off close at the end of the season, and the severe drought prevented the forage making any growth after the pigs were removed. During the season there appeared to be no difference in drought resistance between the two plats.

The check plat of brome-grass dried up before the crop was tall enough to mow, so no yields were obtained.

Acre plats of alfalfa, brome-grass, and sweet clover seeded in rows and broadcasted were planted on April 10. These plats were intended to be used to replace the present pastures the next season. The young plants on these plats were completely killed by drought.

RESULTS IN 1920.

RYE.

A late spring in 1920 delayed opening the pasture season on rye until May 28. The rye at this time averaged about 12 inches in height and was well jointed. Because of the advanced stage of the crop and the late season 15 fall pigs were used instead of 10. These pigs weighed 1,627 pounds when placed on the pasture.

The forage grew too fast to be controlled by grazing, and by June 11 the hogs had confined their feeding to small closely pastured areas, and the rest of the crop was heading. After clipping with a mower on June 11 sufficient moisture was available to send out a new growth of rye. Some of this grew to a height of 4 inches before the entire plat was cleaned up. When the stock was removed on July 9 no forage remained.

During the 42-day period a gain of 270 pounds was made by the pigs. The gain per animal averaged 0.43 of a pound per day. The corn ration fed totaled 1,512 pounds, which was at the rate of 5.6 pounds of corn for each pound of gain.

Rye on the check plat was somewhat damaged by a hailstorm on July 4, and when thrashed on August 23 it yielded but 14.1 bushels of grain per acre.

PEAS.

When placed on the acre of peas on July 9 the 15 pigs from the rye plat weighed 1,897 pounds.

The hailstorm which damaged the check plat of rye on July 4 reduced a very promising pea crop by at least one-half. Practically all the peas were stripped from the vines and many of the vines themselves killed.

During the first two weeks of the pasture period a total gain of 158 pounds was made, but during the last 7 days a loss of 11 pounds was recorded for the lot. The 21-day period, therefore, showed a gain of only 147 pounds, or 0.47 of a pound per pig per day. Corn weighing 800 pounds was consumed, or 5.44 pounds of corn for each pound of gain. This was practically double the corn ratio and about half the average daily gain recorded for the plat in previous years and shows to some extent the value the seed in the peas may have as a part of the pea pasture.

The acre check plat of peas yielded 2.2 bushels of grain. A large percentage of this yield was made up from second-growth pods, the first pods having been destroyed by hail.

BARLEY.

New barley seed of the Success variety was secured for the pasturing work in 1920. The resulting crop was very satisfactory, no bearded barley whatever appearing in the stand.

The 15 hogs from the pea plat were moved to the plat of barley on July 30. The crop was in the soft-dough stage and just beginning to turn. The forage appeared to be very palatable and was readily eaten. During the first few days the animals seemed to find the leaves and straw satisfactory grazing.

By August 10 the barley had been consumed and the pigs were removed. A total gain of 135 pounds was made during the 11 days, or an average daily gain of 0.82 of a pound per pig. The acre check

plat yielded 5.7 bushels of thrashed grain. Taking this yield as representative of that on the pastured plat, it required 2.01 pounds of barley to produce a pound of gain.

The yield of both barley plats was somewhat reduced by the hail-storm of July 4. It appeared that the pastured plat was not as severely damaged as the harvested one.

The three crops added 552 pounds of gain to the initial weight of the 15 pigs in a period of 74 days. Corn fed during the periods on rye and peas totaled 2,312 pounds.

CORN.

A comparatively large yield of corn was available for hogging-down in 1920. The grain was nearly mature when six spring pigs were given access to the plat on September 18. The pigs weighed 387 pounds on this date and were in good condition to make rapid gains. A pasture period of 41 days was required to harvest the corn. During this time the pigs put on a total of 248 pounds, an individual gain of 1.01 pounds daily. As a supplement to the corn fed, the hogs consumed 79 pounds of alfalfa hay fed in racks.

The check plat of corn yielded 14.4 bushels of grain to the acre. Assuming this yield to be representative of that on the pastured plat, each pound of gain required 3.25 pounds of corn. When the hogs were removed from the plat on October 29 they were not in a finished condition.

ALFALFA.

Stands on both the row and broadcast seeded alfalfa plats had been considerably reduced by the drought and pasturing of 1919. The late spring did not permit turning the hogs into the alfalfa fields until May 28. At this time the alfalfa on each plat was about 10 inches high. Though somewhat higher than usual for pasturing, the alfalfa having had plenty of moisture was very succulent and readily eaten by the pigs.

The stand on the row plat appeared to be less than on the broadcast plat. The row alfalfa was therefore allotted four animals while the broadcast plat received six.

As the season advanced the areas where the alfalfa had died out became very weedy, and the plats had to be mowed to keep the weeds from maturing. The pigs were removed on July 9, as it was evident that further grazing would be injurious to the pasture and produce expensive gains in weight.

A total gain of 105 pounds was made by the four pigs on the row alfalfa plat during the 42-day period. This averaged a daily gain of 0.63 of a pound for each animal. The lot of six pigs on the broadcast plat made a gain of 142 pounds, or 0.56 of a pound a day each. Corn totaling 302 pounds was fed to the pigs on the row plat, and 450 pounds of corn were consumed by the animals on the broadcast plat. Gains were produced on the row plat at the rate of 2.88 pounds of corn per pound of gain, while on the broadcast plat 3.17 pounds of corn were required to produce a pound of gain.

An acre of row alfalfa seeded in 1918 and cut for hay this season yielded 2,260 pounds. The acre check plat of broadcast alfalfa cut for hay yielded 1,146 pounds.

BROME-GRASS.

The brome-grass pastures suffered more severely during 1919 than did the alfalfa. An estimate of the stand of each plat made previous to starting the grazing season indicated a stand survival of but 60 per

cent on each plat. The spring growth of grass was also considerably behind the alfalfa, being, on May 28, only 8 inches high and very sickly looking.

On this date two grade Poland China pigs were placed on each brome-grass plat. This breed was used in place of Duroc-Jersey because of the scarcity of fall pigs of the latter breed.

The number of animals used was not sufficient to keep down the growth of vegetation, and both plats were soon covered with a rank growth of weeds. Both plats were mowed to control the weeds. The pigs were removed from both pastures on July 9.

The hogs on the row plat, starting with an initial weight of 170 pounds, gained 50 pounds during the 42 days on pasture, an average of 0.6 of a pound each per day. They received 166 pounds of corn, or 3.32 pounds of corn for each pound of gain.

The lot on the broadcast plat weighed 169 pounds to start with and gained 76 pounds, or 0.9 of a pound a day for each animal. During the 42 days on pasture 169 pounds of corn were fed. This was equal to 2.22 pounds of corn for each pound of gain.

The check plat of broadcasted brome-grass yielded 568 pounds of weedy hay.

RESULTS IN 1921.

RYE.

Winter rye in the pasture experiment did not come up until April 20 and was not ready for grazing until June 9. The forage was about 10 inches high and thinly scattered over the plat. The estimated stand was 50 per cent.

Ten pigs having a weight of 1,262 pounds were placed on the plat on June 9 and remained there until July 14, a period of 35 days. Owing to the thin stand of rye and the droughty conditions during the season, the 10 pigs had little difficulty in controlling the forage over the entire acre.

A gain of 286 pounds was recorded for the lot, or a daily gain of 0.82 of a pound per pig. The corn fed totaled 984 pounds, or 3.44 pounds of corn for each pound of gain.

The yield of the check plat of rye was somewhat reduced by a hailstorm on May 31, but it yielded 5 bushels per acre when thrashed.

PEAS.

The crop of peas was destroyed by hail on May 31, and no results were obtained either by pasturing or by harvesting with machinery.

BARLEY.

The lateness of the rye-pasturing season and the loss of the pea crop necessitated moving the 10 pigs directly from the rye to the barley plat. The barley had been somewhat injured by hail on May 31, but the crop had made considerable growth before the pigs were turned onto it on July 14. The grain was in the soft-dough stage and because of drought was maturing rapidly.

Though the pigs consumed all the grain on the plat with apparent relish, the light yield and poor quality resulted in only small gains.

The pigs were removed on July 28, after a pasture period of 14 days. A gain of 21 pounds was made by the lot, each pig averaging only 0.15 of a pound per day.

The check plat of barley yielded 6.4 bushels per acre of thrashed grain of poor quality.

CORN.

The corn on both the pasture rotation and the harvest rotation died of drought before making grain, and no yields were obtained.

ALFALFA.

A scarcity of fall pigs and the poor condition of the alfalfa pastures necessitated using half-acre areas. The areas having the best stand of alfalfa were fenced off and used for grazing. Both the broadcast and row plats were stocked on May 19 at the rate of six pigs per acre. The lot placed on the row plat totaled 772 pounds per acre, while that on the broadcast plat weighed 728 pounds per acre.

The alfalfa on each plat, though somewhat thinner as to stand than desirable, was about 6 inches high and seemed to be making a good growth. Though the season was dry, the crop made continuous grazing for a period of 70 days. The pigs were removed on July 28.

The pigs on the row plat increased 436 pounds per acre, or at the rate of 1.04 pounds per day each and at the ratio of 1 pound of gain to 3.04 pounds of corn. The pigs on the broadcast plat made a total gain of 402 pounds per acre, which averaged 0.96 of a pound per pig per day. This lot had a ratio of 3.3 pounds of corn fed for each pound of gain.

No alfalfa was obtained from the check plats because of drought

BROME-GRASS.

In order to use areas having fairly uniform stands of brome-grass for pasturing, one-half acre of the row plat was used and one-fourth acre of the broadcast plat. When the pigs were placed on these plats on May 19, the brome-grass averaged 6 inches in height. The stand on each plat was thinner than was desirable.

The row plat was stocked at the rate of six pigs per acre, with an initial weight of 732 pounds. The lot on the broadcast plat was at the rate of eight pigs per acre, totaling 1,012 pounds. The row plat produced continuous grazing for a period of 70 days, but on the broadcast plat the hogs had to be removed at the end of 62 days.

A gain of 0.74 of a pound per day for each animal, or 310 pounds per acre for the lot, was made on the row plat, while the individual daily average of the pigs on the broadcast plat was 0.9 of a pound, or a total of 436 pounds per acre.

Corn fed to the row-plat hogs totaled 1,246 pounds to the acre, or 4.02 pounds of corn for a pound of gain. The pigs on the broadcast plat received an acre total of 1,412 pounds of corn, or 3.24 pounds of grain for each pound of gain.

No yields were obtainable from the check plat of brome-grass because of the drought.

The duplicate perennial pastures seeded in 1919 and fallowed in 1920 were reseeded in the spring of 1921.

STUDY OF THE RESULTS WITH DIFFERENT CROPS.[4]

The data on pasturing the four crops, rye, peas, barley, and corn, in the 4-year rotation for the years from 1916 to 1921, inclusive, are assembled in four tables, one for each crop. The averages at the bottom of each table were determined for the number of years the crops were actually pastured, exclusive of 1915.

[4] For information on the pasturing of irrigated crops with hogs and the feeding of hogs while on pasture and in the feed lot, see the published reports of the work of the Huntley experiment farm, Bureau of Plant Industry, for the years 1913 to 1921, inclusive, by Dan Hansen, Farm Superintendent.

Rye has been pastured every year since 1915. The detailed results are given in Table 1. The average pasture period was from May 14 to July 4, a period of 51 days, for an average of 10.2 pigs per acre. These pigs with an average initial weight of 1,104 pounds gained an average of 279 pounds, or 0.58 of a pound a day for each animal. Corn averaging 1,228 pounds was fed to supplement the pasture. This averaged 4.42 pounds of corn for each pound of gain.

TABLE 1.—*Results obtained by pasturing 1 acre of winter rye with fall pigs at Huntley, Mont., each year from 1916 to 1921, inclusive.*

Year.	Number of pigs.	Pasture period.			Weights of animals and feed (pounds).						Yield of check plat (bushels).
					Hog weights.				Corn consumed.		
		Date on.	Date off.	Days.	Initial.	Final.	Gain.	Daily gain per pig.	Total.	Per pound of gain.	
1916	[1] 10	May 6	June 30	55	1,171	1,510	339	0.62	1,480	4.37	19.2
1917	[2] 6	May 11	July 17	67	499	762	263	.65	910	3.46	10.4
1918	10	May 7	June 25	49	964	1,191	227	.46	1,078	4.75	10.1
1919	10	Apr. 25	June 20	56	1,103	1,390	287	.51	1,403	4.89	3.6
1920	15	May 28	July 9	42	1,627	1,897	270	.43	1,512	5.60	14.1
1921	10	June 9	July 14	35	1,262	1,548	286	.82	984	3.44	5.0
Average, 6 years.	10.2	May 14	July 4	51	1,104	1,383	279	.58	1,228	4.42	10.4

[1] One of these pigs was pregnant during the pasture season. A weight equal to the average of the other nine is taken for this animal in the above calculations.
[2] At the end of 61 days one pig was removed because of pregnancy. A weight equal to the average of the other five is used for the removed animal in these calculations.

The average yield of rye on the check plat was 10.4 bushels per acre.

Peas were pastured every year since the experiments were started except in 1921, in which year the crop was destroyed by hail. As the work in 1915 was of a preliminary nature and the pasture was not continuous with the other crops in the rotation, the results for that year are not considered in the assembled data, which are given in Table 2.

TABLE 2.—*Results obtained by pasturing 1 acre of peas with fall pigs at Huntley, Mont., each year from 1916 to 1920, inclusive.*

Year.	Number of pigs.	Pasture period.			Weights of animals and feed (pounds).						Yield of check plat (bushels).
					Hog weights.				Corn consumed.		
		Date on.	Date off.	Days.	Initial.	Final.	Gain.	Daily gain per pig.	Total.	Per pound of gain.	
1916	[1] 10	June 30	July 20	20	1,510	1,780	270	1.35	636	2.36	10.9
1917	[2] 6	July 17	Aug. 8	22	741	915	174	1.32	358	2.06	2.3
1918	10	June 25	July 9	14	1,191	1,420	229	1.64	364	1.59	5.6
1919	10	June 20	June 27	7	1,390	1,467	77	1.10	207	2.69	0
1920	15	July 9	July 30	21	1,897	2,044	147	.47	800	5.44	2.2
Average, 5 years.	10.2	July 2	July 19	17	1,346	1,525	179	1.18	473	2.83	4.2

[1] One sow was with pig. Weight for this animal was calculated as in the rye pasture (Table 1).
[2] Five pigs from the rye plat and one from the brome-grass plat.

The average for the five years from 1916 to 1920, inclusive, was 10.2 hogs per acre on peas from July 2 to July 19, a total of 17 days. At the beginning of this period the total weight averaged 1,346 pounds. An average increase in weight of 179 pounds was obtained. This was at the rate of 1.18 pounds per day for each pig. The supplementary corn ration averaged 473 pounds, or 2.83 pounds of corn for a pound of gain.

The check plat of peas yielded nothing in 1919, because of drought, and the crop was killed out by hail in 1921. The average yield of the peas from 1916 to 1920, including the zero yield of 1919, was 4.2 bushels per acre.

At no time did the 1 acre of peas furnish sufficient forage to carry the 10 pigs from the period of best grazing on the rye to that on barley.

Beardless barley (Success variety) has been pastured every year since 1916 with the exception of 1919, when the crop was killed by drought. The results are presented in Table 3.

TABLE 3.—*Results obtained by pasturing 1 acre of barley with fall pigs at Huntley, Mont., each year from 1916 to 1921, exclusive of 1919.*

Year.	Number of pigs.	Pasture period.			Weights of animals and feed (pounds).						Yield of check plat (bushels).
					Hog weights.				Barley consumed.[1]		
		Date on.	Date off.	Days.	Initial.	Final.	Gain.	Daily gain per pig.	Total.	Per pound of gain.	
1916	[2] 10	July 20	Aug. 7	18	1,780	1,766	−14	−0.08	462	.....	9.7
1917	6	Aug. 8	Aug. 22	14	915	975	60	.71	777	12.95	16.2
1918	10	July 9	July 23	14	1,420	1,420	0	0	142	.....	3.0
1919 [3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1920	15	July 30	Aug. 10	11	2,044	2,179	135	.82	272	2.01	5.7
1921 [4]	10	July 14	July 28	14	1,548	1,569	21	.15	305	14.52	6.4
Average, 5 years.	10.2	July 22	Aug. 5	14	1,541	1,582	40	.35	392	.....	8.2

[1] Weight of grain from the check plat.
[2] The weight of one of these pigs was calculated as was done for the rye pasture (Table 1).
[3] The crop dried up before the pasture season, and no hogs were put on the plat.
[4] Hogs were moved from the rye plat directly to the barley plat because of the destruction of the pea plat by hail.

The pasture period averaged from July 22 to August 5, a total of 14 days, for an average of 10.2 pigs. The average initial weight of these pigs was 1,541 pounds, and the gains made averaged 40 pounds. The daily gain per pig each year averaged 0.35 pound.

The low gains were due chiefly to low yields of grain and the unpalatability of the forage.

Barley on the check plat averaged 8.2 bushels per acre for the five years when a crop was produced.

Using the yield of barley that might have been harvested as a basis of calculation, it required from 2.01 pounds of barley in 1920 to 14.5 pounds in 1921 to make a pound of gain. In 1916 there was a loss in weight on the barley pasture, and in 1918 no gains were made.

No corn was produced in either 1919 or 1921. With these exceptions corn has been pastured each year. For reasons stated above, the returns for 1915 have not been included in the assembled data

(Table 4). An average of 5.5 spring pigs has been used. It took these pigs an average period of 20 days, extending from September 20 to October 10, to harvest the acre. The average total weight of these pigs was 426 pounds at the beginning of the period, and they gained an average of 119 pounds. The average daily gain per pig for the four years was 1.19 pounds per day.

TABLE 4.—*Results obtained by pasturing 1 acre of corn with spring pigs at Huntley, Mont., in 1916, 1917, 1918, and 1920.*

Year.	Number of pigs.	Pasture period.			Weights of animals and feed (pounds).						Yield of check plat (bushels).
					Hog weights.				Corn consumed.[1]		
		Date on.	Date off.	Days.	Initial.	Final.	Gain.	Daily gain per pig.	Total.	Per pound of gain.	
1916	4	Sept. 30	Oct. 9	9	435	506	71	1.97	924	13.00	16.5
1917	6	Sept. 28	Oct. 15	17	442	545	103	1.01	538	5.22	9.6
1918	6	Sept. 6	Sept. 18	12	442	496	54	.75	448	8.30	8.0
1919[2]											
1920	6	Sept. 18	Oct. 29	41	387	635	248	1.01	806	3.25	14.4
Average, 4 years.	5.5	Sept. 20	Oct. 10	20	426	545	119	1.19	679	7.44	12.1

[1] Yield of check plat.

[2] Corn dried up before making grain.

The average yield of the check plat was 12.1 bushels per acre. With this yield as a basis, the pigs averaged 1 pound of gain for each 7.44 pounds of corn eaten. An average of 57 pounds of alfalfa hay was fed with the corn.

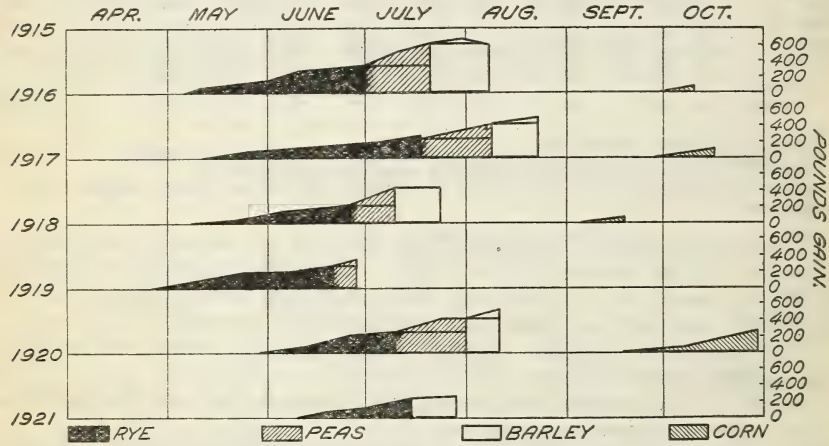

FIG. 1.—Diagram showing graphically the period in each year during which pigs were pastured on rye, peas, barley, and corn and the gain made while on each crop and between each weighing, arranged to show the combined gain on rye, peas, and barley.

Figure 1 presents graphically the data obtained from this rotation each year. The base line of each figure represents the initial weight of the hogs. The increase in height of the figure represents the increase in weight of the hogs as the season progresses. In other words, the

gain in height of the figure represents the gain in hog weights above the first weight of the season. Thus, in 1917 the pigs were placed on the rye plat on May 11 and increased steadily in weight until at the end of the barley period, August 22, a total gain of 497 pounds had been made. The rise of peas above rye shows the gain made on peas, and the rise of barley over peas indicates the gain made on barley.

Besides the increase in weight for each crop, the diagram shows the period during which each crop was pastured.

TABLE 5.—*Results obtained by pasturing 1 acre of alfalfa with pigs at Huntley, Mont., each year from 1918 to 1921, inclusive.*

Kind of plats and year.	Number of pigs.	Pasture period.			Weights of animals and feed (pounds).						Yield of check plat.
					Hog weights.				Corn consumed.		
		Date on.	Date off.	Days.	Initial.	Final.	Gain.	Daily gain per pig.	Total.	Per pound of gain.	
Cultivated rows:											
1918	6	May 7	July 9	63	532	828	296	0.78	890	3.01	.....
1919	4	May 9	June 27	49	318	448	130	.66	376	2.89	0
1920	4	May 28	July 9	42	303	408	105	.63	302	2.88	2,260
1921	6	May 19	July 28	70	772	1,208	436	1.04	1,326	3.04	0
Average	5	May 16	July 11	56	481	723	242	.78	724	2.96	753
Plats sown broadcast:											
1918	8	May 7	July 9	63	702	1,050	348	.69	1,148	3.30	1,254
1919	7	May 9	June 27	49	530	718	188	.55	604	3.21	0
1920	6	May 28	July 9	42	458	600	142	.56	450	3.17	1,146
1921	6	May 19	July 28	70	728	1,130	402	.94	1,326	3.30	0
Average	6.8	May 16	July 11	56	605	875	270	.69	882	3.25	600

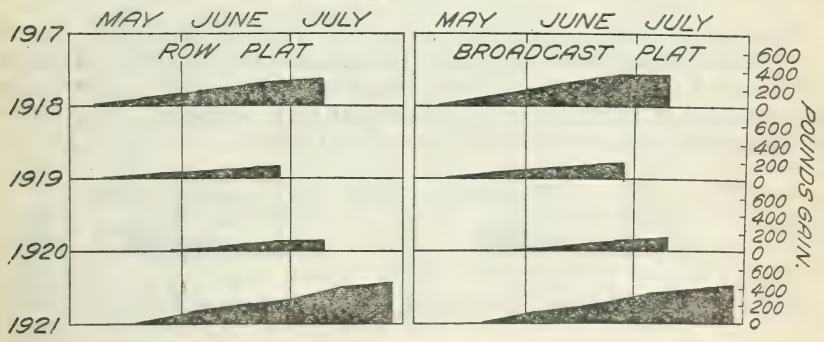

FIG. 2.—Diagram showing graphically the period in each year during which pigs were on alfalfa in rows and alfalfa sown broadcast and the gains made on each pasture and between weighings.

The data obtained on the alfalfa pastures are presented in Table 5 and shown graphically in Figure 2. This has been reduced to an acre basis for each year. Some preliminary pasturing was done with fall and spring pigs on alfalfa, but the data given in the table and the figure are for the years from 1918 to 1921, inclusive. During these years the average number of pigs used was 5 for the row plat and 6.8 for the broadcast plat. Both plats had the same pasture period, averaging 56 days from May 16 to July 11.

On the row plat the average daily gain per pig for each of the four years averaged 0.78 of a pound. A supplementary ration of corn was fed. The 4-year average ratio is 2.96 pounds of corn per pound of gain.

The lots on the broadcast plat made an average daily gain of 0.69 of a pound. This required an average of 3.25 pounds of corn for each pound of gain.

TABLE 6.—*Results obtained by pasturing 1 acre of brome-grass with pigs at Huntley, Mont., each year from 1918 to 1921, inclusive.*

Kind of plats and year.	Number of pigs.	Pasture period.			Weights of animals and feed (pounds).						Yield of check plat.
					Hog weights.				Corn consumed.		
		Date on.	Date off.	Days.	Initial.	Final.	Gain.	Daily gain per pig.	Total.	Per pound of gain.	
Cultivated rows:											
1918	8	Apr. 30	July 9	70	764	1,114	350	0.63	1,344	3.84	.....
1919	6	Apr. 25	June 14	50	582	726	144	.48	653	4.53	.....
1920	2	May 28	July 9	42	170	220	50	.60	166	3.32	.....
1921	6	May 19	July 28	70	732	1,042	310	.74	1,242	4.02	.....
Average	5.5	May 11	July 8	58	562	776	214	.61	851	3.92	.....
Plats sown broadcast:											
1918	8	Apr. 30	July 9	70	778	1,152	374	.67	1,344	3.59	664
1919	6	Apr. 25	June 14	50	579	770	191	.64	653	3.42	0
1920	2	May 28	July 9	42	169	245	76	.90	169	2.22	568
1921	8	May 19	July 19	61	1,012	1,448	436	.90	1,412	3.24	0
Average	6	May 11	July 5	55	635	904	269	.78	895	3.11	308

The brome-grass pasture results are shown in Table 6 and Figure 3. When reduced to an acre basis, the row plat has carried an average of 5.5 pigs for a period of 58 days from May 11 to July 8. These pigs have made an average daily gain of 0.61 of a pound. The ratio is 1 pound of gain for each 3.92 pounds of corn.

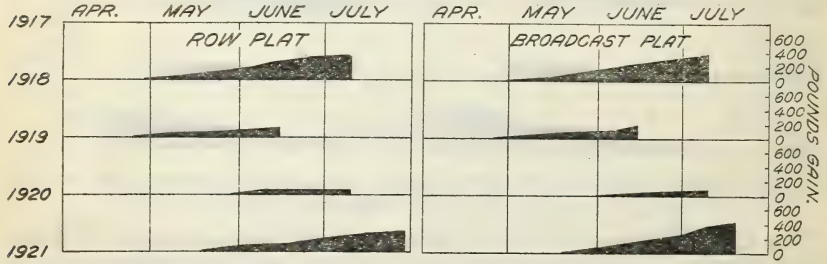

FIG. 3.—Diagram showing graphically the period in each year during which pigs were on brome-grass in rows and brome-grass sown broadcast and the gains made on each pasture and between weighings.

Six pigs were carried on the broadcast plat for an average of 55 days. This period was from May 11 to July 5. An average daily gain of 0.78 of a pound per pig was made on this plat. Corn fed amounted to an average of 3.11 pounds of grain for each pound of gain.

Table 7 presents the combined returns from the several systems of the continuous pastures.

TABLE 7.—*Average returns from the several pastures or continuous pasture periods.*

Pasture.	Years averaged.	Pasture period.			Number of pigs.	Weights of animals and feed (pounds).			
		Date on.	Date off.	Days.		Gain.	Daily gain per pig.	Grain supplement.	
								Total.	Per pound of gain.
Rye, peas, and barley	6	May 14	July 30	75	10.2	462	0.60	[1] 1,701	3.68
Alfalfa in rows	4	May 16	July 11	57	5	242	.77	[2] 724	2.96
Alfalfa sown broadcast	4	...do...	...do...	57	6.8	270	.69	[2] 882	3.25
Brome-grass in rows	4	May 11	July 7	58	5.5	214	.61	[2] 851	3.92
Brome-grass sown broadcast	4	...do...	July 5	56	6	269	.78	[2] 895	3.11
Corn	4	Sept. 21	Oct. 10	20	5.5	119	1.14	[3] 0	.....

[1] Corn fed on rye and peas. [2] Corn.
[3] Average yield of corn from the check plat, 865 pounds. This was converted into gains at the rate of 7.44 pounds of corn for each pound of gain.

The 3 acres of forage, consisting of rye, peas, and barley, when pastured consecutively carried an average of 10.2 pigs for an average grazing period of 77 days. During this time the gain made averaged 462 pounds, or 0.6 of a pound per pig per day. This gain was made at an expense of 3.68 pounds of corn for each pound of increase.

Alfalfa in rows had a 4-year average of five pigs to the acre for a 56-day period. They increased in weight 242 pounds and consumed 724 pounds of corn. The average daily gain per pig was 0.78 of a pound, and the ratio of corn fed to gain is 2.96 to 1.

An average of 6.8 pigs were supported for 56 days on an acre of alfalfa seeded broadcast. The average daily gain per pig was 0.69 of a pound. It required 3.25 pounds of corn as a supplement to make a pound of gain.

The acre of brome-grass in rows carried an average of 5.5 pigs continuously for 58 days. The gains made averaged 214 pounds, or 0.61 of a pound a day for each animal. It required 3.92 pounds of corn supplement to make 1 pound of gain.

Brome-grass sown broadcast had a carrying capacity of six pigs for 55 days. This lot made 269 pounds of gain, an average daily gain of 0.78 of a pound per pig. Corn consumed was at the ratio of 3.11 pounds of grain for every pound of gain.

The acre of corn had a 4-year average of 5.5 pigs for 20 days. These gained 119 pounds during the period. The average daily gain was 1.19 pounds each. When the yields of the check plat of corn are taken as a basis for the grain ratio, 7.44 pounds of corn were required for each pound of gain.

CONCLUSIONS.

It is fully realized that the data so far obtained from these experiments are not conclusive and that the work must be carried on for a longer period of years before its value can become accurately established. The diversity of conditions affecting the procedure and the results of the experiment from year to year call for a careful study of each year as a unit. This is more necessary, perhaps, where the live stock is a factor to be considered along with the crop production than when only the crops are influenced.

In order to make a direct comparison and so determine the value of these pastures, it is planned to carry a lot of hogs in a feed pen without pasture but receiving a full ration of corn during the pasture season.

Regarding the five points about which the work was outlined, it is believed that rather marked indications have been obtained regarding the seasons during which each crop may give the best returns from grazing, the comparative number of hogs which an acre of each crop will carry, and the possibility of furnishing continuous grazing. To date, no definite information has been obtained on the value of manure resulting from pasturing or of the economic merits of pasturing over harvesting the crops used. It is yet impossible to state the influence that manure may have had on the rye and pea crops, because the rye was grazed off or clipped before maturity and the damage to the pea crop by hail offset any increase in growth that may have been induced by manure. The effect of manure has not been apparent at any time on the barley and corn crops.

With the exception of 1921, as indicated in Table 1, the beginning of the pasture season for rye does not vary widely from the average date of May 16. The length of the grazing period will depend upon the number of hogs used and the season, but the total gains made have been comparatively uniform, no matter how many pigs were used or how long they were on the pasture. The high pork returns have not necessarily correlated with high grain returns from the check plat.

The crop of peas suffered from hail three years out of five, which factor influenced the returns received. Peas proved to be a very palatable forage, but light yields even when the crop had not been reduced by hail would seem to warrant at least 2 acres of peas to 1 of rye.

Barley was severely checked by drought practically every year, and comparatively low yields resulted. Small yields of grain and the apparent unpalatability of the barley resulted in generally poor gains.

Alfalfa and brome-grass proved to be generally palatable forage, and the dates of opening the pasture season on these crops were fairly well established. The deviation was not far from May 11. The length of the pasture period depended more upon the season and the stand of the forage than upon the number of hogs used. It so happened that gains made were generally greater with the larger number of pigs used and with the longer pasture periods.

The perennial pastures made somewhat more profitable returns than any one of the annual pastures, and in most cases the perennial pasture gave more profitable returns per acre than the continuous annual pastures.

Considerable experimental work is yet needed to establish a system of continuous grazing and, if possible, continue the season of green-forage pasture beyond the period when field peas are available, thus supplementing the barley pasture with green forage or eliminating barley entirely. It would seem desirable to have green forage until the time corn is ready for harvesting. This would permit the use of two crops of pigs a year and so increase the efficiency of hog production as a factor toward the diversification of present dry-farming practices. Experiments for the study of several crops in regard to their ability to furnish green forage during the latter part of the summer have been outlined, and some of the work is already under way.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923